



**Office de la propriété
Intellectuelle
du Canada**

Un organisme
d'Industrie Canada

**Canadian
Intellectual Property
Office**

An Agency of
Industry Canada

Brevet canadien / Canadian Patent

Le commissaire aux brevets a reçu une demande de délivrance de brevet visant une invention.

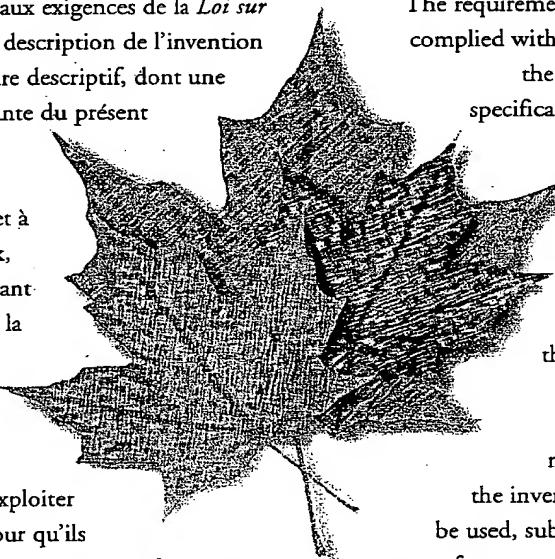
Ladite requête satisfait aux exigences de la *Loi sur les brevets*. Le titre et la description de l'invention figurent dans le mémoire descriptif, dont une copie fait partie intégrante du présent document.

Le présent brevet confère à son titulaire et à ses représentants légaux, pour une période expirant vingt ans à compter de la date du dépôt de la demande au Canada, le droit, la faculté et le privilège exclusif de fabriquer, construire, exploiter et vendre à d'autres, pour qu'ils l'exploitent, l'objet de l'invention, sauf jugement en l'espèce rendu par un tribunal compétent, et sous réserve du paiement des taxes périodiques.

The Commissioner of Patents has received a petition for the grant of a patent for an invention.

The requirements of the *Patent Act* have been complied with. The title and a description of the invention are contained in the specification, a copy of which forms an integral part of this document.

The present patent grants to its owner and to the legal representatives of its owner, for a term which expires twenty years from the filing date of the application in Canada, the exclusive right, privilege and liberty of making, constructing and using the invention and selling it to others to be used, subject to adjudication before any court of competent jurisdiction, and subject to the payment of maintenance fees.



BREVET CANADIEN

2,371,251

CANADIAN PATENT

Date à laquelle le brevet a été accordé et délivré

2004/02/17

Date on which the patent was granted and issued

Date du dépôt de la demande

2000/04/28

Filing date of the application

Date à laquelle la demande est devenue accessible au public pour consultation

2001/02/01

Date on which the application was made available for public inspection

Commissaire aux brevets / Commissioner of Patents

Canada

3256 (CIPO 91) 02/03

O P I C C I P C



Office de la Propriété
Intellectuelle
du Canada
Un organisme
d'Industrie Canada

Canadian
Intellectual Property
Office
An agency of
Industry Canada

CA 2371251 C 2004/02/17

(11)(21) 2 371 251

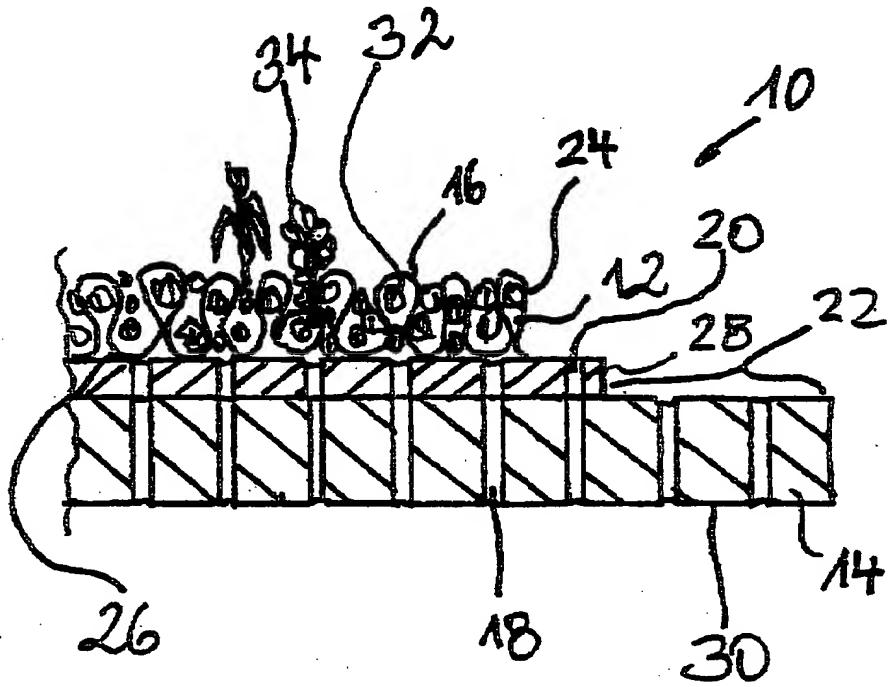
(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2000/04/28
(87) Date publication PCT/PCT Publication Date: 2001/02/01
(45) Date de délivrance/Issue Date: 2004/02/17
(85) Entrée phase nationale/National Entry: 2001/10/23
(86) N° demande PCT/PCT Application No.: DE 2000/001386
(87) N° publication PCT/PCT Publication No.: 2001/006837
(30) Priorité/Priority: 1999/07/21 (199 34 203.2) DE

(51) Cl.Int. 7/Int.Cl. 7 A01G 1/00, E04D 11/00
(72) Inventeur/Inventor:
BEHRENS, WOLFGANG, DE
(73) Propriétaire/Owner:
BEHRENS, WOLFGANG, DE
(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : CORPS VEGETAL EN FORME DE BANDE POUR L'ENGAZONNEMENT DE TOITS SELON LA METHODE
DES COUCHES MINCES
(54) Title: STRIPLIKE BODY OF VEGETATION FOR COVERING ROOFS WITH THIN LAYERS OF VEGETATION



(57) Abrégé/Abstract:

Disclosed is a striplike body of vegetation which is used to cover roofs with thin layers of vegetation. The inventive body of vegetation is comprised of structural matting arranged on at least one base. The structural matting can be filled with a substrate and germinative plant material, especially seeds, shoots, spores or parts of shoots. The base consists of a feltlike nonwoven material which is only slightly permeable with respect to wind but which has a substantial water storage capacity. According to the invention, the striplike body of vegetation is characterized in that at least the base is permeable with respect to wind as a result of the introduction of holes.

Canada

<http://opic.gc.ca> · Ottawa-Hull K1A 0C9 · <http://cipo.gc.ca>

OPIC · CIPO 191

OPIC CIPO

5 **STRIPLIKE BODY OF VEGETATION USED TO COVER ROOFS WITH THIN LAYERS OF VEGETATION**

10 The present invention relates to a striplike body of vegetation used to cover roofs with thin layers of vegetation, with structural matting, which is arranged on at least one underlay. The structural matting is filled with a substrate and plant material capable of germination. The underlay is a felt-like non-woven material with low wind permeability and high water storage capacity, and at least the underlay is provided with holes which render the underlay permeable to the wind.

15 A further aspect of the present invention relates to a process for the manufacture of such a body of vegetation.

20 The concept of striplike bodies of vegetation used to cover roofs with thin layers of vegetation, as such, is known. For example, patent no. DE 197 40 682 A1 discloses mat-type vegetation carriers, which feature structural matting arranged on an underlay. Such bodies of vegetation are relatively thin and, by contrast with conventional substrate designs, combine several functions within them.

25 The structural matting serves to accommodate the substrate and roots of the plants, whereby the structural matting is intended to secure the hold of the substrate and the plants. The underlay, applied to the underside in the form of a felt-like non-woven material serves to store water. The usual layer thickness of such bodies of vegetation is about 1 to 5 cm. These bodies of vegetation for covering roofs with thin layers of vegetation are advantageous because they are relatively light, and as a result of which, the roof loading is increased to only some 30 kg per square metre, while by contrast, substrate structures incur an increased roof loading of more than 80 kg/m².

5

At the same time however, the low weight of such bodies of vegetation is problematic, since such bodies of vegetation on roofs with a height of more than eight metres are subjected to critical wind suction, which leads to the mats being sucked up and raised by wind suction forces. This leads to suction peaks due to 10 the buoyancy of the bodies of vegetation, which impose a burden on the bodies of vegetation themselves, the foliation, and the roof structure.

It has already been proposed in DE 197 40 682 A1 that the wind forces be countered by several striplike bodies of vegetation being laid overlapping, as a 15 result of which the situation is achieved in which the roots of plants root through two overlapping bodies of vegetation and the bodies of vegetation are connected at the side edges. Such an arrangement results in a situation in which the wind can no longer flow beneath the bodies of vegetation. Nevertheless, even mats of this type cannot counteract the wind suction forces, which arise on the upper 20 side, since the thick, felt-like underlay functions almost like an impermeable membrane, which can be sucked up by the wind suction forces.

It has already been proposed that the wind suction forces be counteracted by the bodies of vegetation being provided with a scattered layer of gravel and 25 thereby stabilised. This gravel burden for securing the position of the bodies of vegetation, however, increases the load burden on the roof to an undesirable degree, which should be kept as low as possible. Hitherto the increase in the roof loading by scattering gravel to secure the position of such bodies of vegetation was the only feasible method, since it was always taken as a basic 30 principle that a body of vegetation is secure in its position if the resultant wind load, which exerts a raising effect, is smaller than the surface weight of the vegetation mats. Accordingly, with higher wind loads, the surface weight of the vegetation mats increased. Hitherto no other procedure was possible, since,

5 because of the high flow resistance when wind flows through the bodies of vegetation, the surface permeability is comparatively low.

The inventor has therefore taken as the problem the creating of a body of vegetation used to cover roofs with thin layers of vegetation, which, while 10 maintaining low surface weight and retaining the functions of such bodies of vegetation, is also secure in its position, i.e. insensitive to wind suction even at great roof heights.

This problem is resolved by a striplike body of vegetation used to cover 15 roofs with thin layers of vegetation, with structural matting, which is arranged on at least one underlay. The structural matting is filled with a substrate and plant material capable of germination. The underlay is a felt-like non-woven material with low wind permeability and high water storage capacity, and at least the underlay is provided with holes which render the underlay permeable to the wind.

20 In a surprisingly simple manner, the effect is achieved with the holes that no surfaces are offered any longer to the wind suction, since, as a result of the holes, the otherwise closed underside is interrupted or opened, so that an immediate equalization of pressure occurs between top side and underside.

25 This, then, simulates an effect which is otherwise only found with conventional heavy substrate formats, since in that case the substrate particles cause a large number of pores or openings to be present, as a result of which such structures behave in a neutral manner towards wind suction. If the underlay is now provided with holes, the body of vegetation as a whole no longer provides any 30 resistance surface to the wind, and therefore, there is no longer any rising of the body of vegetation.

5 In an experimental trials it has been found, with measurements based on DIN 1055 Part 4, that with different wind dynamic pressure values at the altitude ranges from 0 m to 8 m and 8 m to 20 m, with a dynamic pressure q , in a range from 0.5 to 0.8 kN/m^2 , bodies of vegetation provided with holes were secure in their position which featured a weight of less than 40 kg/m^2 .

10 A further advantageous effect which can be specifically achieved by the holes is that the draining effect of the underlay can be improved by the holes, without water storage capacity of the underlay being significantly reduced. The underlay is intended not only to be able to store water, in particular during dry periods, but should also be in a position to allow surplus water to run off, with a corresponding gradient, since otherwise the gas exchange of the roots of the plants could become critical. As a result of the holes, the air content of the underlay is also improved, and better rooting of the plants in the layer structure beneath the underlay is achieved.

15 20 In advantageous embodiments of the invention, provision can be made for the underlay to feature a weight from 30 to $3,500 \text{ g/m}^2$, for the bodies of vegetation to be provided with 50 to 1,500 holes per square metre, whereby the holes feature a diameter of 2 to 20 mm, and for the number of holes to be selected as a function of the roof height. With known wind loadings, the permeability value can be calculated.

25 In practical embodiments of the invention, provision can be made for the structural matting to be a looped mat or a fibre mat, in particular a fibre mat made of coconut fibres, and for the underlay to be a dense needle non-woven material, a polyester non-woven material, a polypropylene non-woven material, a dense cotton non-woven material, or a rock wool mat.

5 Provision may further be made for reinforcement to be arranged between the structural matting and underlay, to accommodate the tensile forces. Such reinforcement, for example a lattice mesh, thin but stable polyester non-woven material, and other feasible materials, serve to accommodate the tensile forces incurred when the body of vegetation is laid on a roof with a pitch of greater than
10 10°, which neither the structural matting nor the underlay are in a position to do.

In a further practical embodiment, provision is made for the structural matting to be arranged on the underlay in such a way that a first side edge area of the structural matting projects over the first side edge of the underlay, that an
15 opposed second side edge area of the underlay projects beneath a second side edge of the structural matting, so that structural matting and underlay of adjacent bodies of vegetation overlap one another in each case, and that the mutually-overlapping areas in the cultivated state of the bodies of vegetation are connected to one another as a consequence of the root penetration activity of the
20 plants.

In this situation, the advantages of the body of vegetation according to the invention are combined in an advantageous manner with those of a body of vegetation known from DE 197 40 682 A1, with the result that a body of
25 vegetation designed in this manner is not only positionally secure, but is also insensitive to dry shrinkage.

With a process for the manufacture of a body of vegetation according to the invention for providing vegetation on roofs in thin strips, in a first step the
30 body of vegetation is first unrolled flat on a film which is secure against root penetration; in a second step, the body of vegetation is filled with substrate and plant material capable of germination, and looked after in gardening fashion; in a third step, the holes are provided by mechanical means through the body of

5 vegetation into the underlay; and in a fourth step the body of vegetation is rolled up and conveyed to the roof.

Advantageous with this process for the manufacture of the vegetation carrier according to the invention is that the holes are applied simply, rapidly, and 10 economically in the bodies of vegetation lying on the site. In this situation, the tensile reinforcement arranged if necessary between the structural matting and the underlay is perforated together with them.

In view of the fact that such bodies of vegetation are as a rule harvested by 15 mechanical means, it is possible, if required, for the perforation to be carried out at the same time as the unrolling of the bodies of vegetation.

As an alternative, the process can be carried out with the third stage being left out, if a body of vegetation is used of which the underlay has already been 20 provided with holes prior to its being laid on the film.

Further advantages and embodiments of the invention are described on the basis of an embodiment in the drawing, as well as in the description on the basis of an embodiment, and described in greater detail in the Patent Claims.

25

The drawing shows an embodiment of a body of vegetation 10 according to the invention, in a longitudinal section. The body of vegetation 10 corresponds largely to a body of vegetation known from DE 197 40 682 A1, and features a structural matting 12, which is arranged above an underlay 14. In the 30 embodiment shown, the structural matting 12 is represented as a looped mat 16 made of polyamide looped fabric, which is filled with substrate 32 and with plants 34. The substrate 32 in this situation is a substrate for extensive roof vegetation coverage.

5

The underlay 14 in the embodiment shown is a dense cotton non-woven material 30, which features a high water storage capacity. Arranged between underlay 14 and structural matting 12 is a polyester non-woven material 28, which serves to accommodate tensile forces. Instead of the polyester non-woven material 28, it is also possible for a PE lattice fabric or similar material to be used. The underside 26 of the polyester non-woven material 28 can be adhesively bonded, quilted or connected in some other suitable manner to the underlay 14. The polyester non-woven material 28 can be connected to the structural matting 12 accordingly.

15

According to a matting known from DE 197 40 682 A1, the body of vegetation 10 features a first side edge area, not shown in the drawing, a first side edge, likewise not shown, a second side edge area 22, and a second side edge 24. These overlapping and underlapping areas serve to merge together two vegetation carriers 10, whereby, as a result of the rooting activity of the plants, these two overlapping vegetation carriers 10 are connected to one another.

The underlay 14, formed as a cotton non-woven material 30, and the polyester non-woven material 28, are provided with holes 18, 20. The holes 18, 20 are introduced into the underlay 14 and into the polyester non-woven material 28 respectively, by mechanical means referred to as "dibbers", by means of agricultural equipment during the horticultural care of the bodies of vegetation.

30 The effect of the holes 18, 20 is that the wind cannot attack the bodies of vegetation 10 over a flat surface area namely, the sealing film which is as a rule, arranged beneath the body of vegetation 10 on a roof, and permanently secured to the roof so that the film cannot be lifted by wind suction. Accordingly, an

- 5 underpressure finds no surface to attack; the body of vegetation 10 is secure in its position thanks to the holes 18, 20.

CLAIMS

1. A striplike body of vegetation used to cover roofs with thin layers of vegetation, said body comprising structural matting, arranged on at least one underlay, the structural matting being filled with a substrate and plant material capable of germination; and the underlay being a felt-like non-woven material with low wind permeability and high water storage capacity, and at least the underlay being provided with holes which render the underlay permeable to the wind.
2. The striplike body of vegetation according to Claim 1 wherein the plant material capable of germination is selected from the group of materials comprising seeds, sprouts, spores and sprout pieces.
3. The striplike body of vegetation according to Claim 1 or 2, wherein the underlay features a weight distribution from 30 to 3,500 g/m².
4. The striplike body of vegetation according to any one of Claims 1 to 3, wherein the body of vegetation is provided with 50 to 1,500 holes per square metre, whereby the holes each have a diameter of 2 to 20 mm.
5. The striplike body of vegetation according to any one of Claims 1 to 4, wherein the number of holes is selected as a function of the roof height.
6. The striplike body of vegetation according to any one of Claims 1 to 5, wherein the structural matting is a looped mat.
7. The striplike body of vegetation according to any one of Claims 1 to 5, wherein the structural matting is a fibre mat.

8. The striplike body of vegetation according to Claim 7 wherein the fibre mat is made of coconut fibres.
9. The striplike body of vegetation according to any one of Claims 1 to 8, wherein the underlay is a dense needle non-woven material.
10. The striplike body of vegetation according to any one of Claims 1 to 8, wherein the underlay is a polyester non-woven material.
11. The striplike body of vegetation according to any one of Claims 1 to 8, wherein the underlay is a polypropylene non-woven material.
12. The striplike body of vegetation according to any one of Claims 1 to 8, wherein the underlay is a dense cotton non-woven material.
13. The striplike body of vegetation according to any one of Claims 1 to 8, wherein the underlay is a rock wool mat.
14. The striplike body of vegetation according to any one of Claims 1 to 13, wherein arranged between the structural matting and the underlay is reinforcing to accommodate tensile forces.
15. The striplike body of vegetation according to any one of Claims 1 to 14, wherein the structural matting is arranged on the underlay in such a way that a first side edge area of the structural matting projects over a first side edge of the underlay, that an opposite second side edge area of the underlay projects beneath a second side edge of the structural matting, so that the structural

matting and underlay of adjacent bodies of vegetation overlap into one another, and so that the overlapping areas are combined with one another in the cultivated state of the bodies of vegetation as a consequence of inter-rooting activity of plants.

16. A process for the manufacture of a striplike body of vegetation used to cover roofs with thin layers of vegetation in accordance with any one of Claims 1 to 15, in which, in a first step, the body of vegetation is rolled out flat on a film secure against root penetration, in a second step the body of vegetation is filled with substrate and germinative plant material and cared for horticulturally, in a third step the holes are applied by machine through the body of vegetation into the underlay, and in a fourth step the body of vegetation is rolled up and conveyed to the roof.

17. A process for the manufacture of a striplike body of vegetation used to cover roofs with thin layers of vegetation in accordance with any one of Claims 1 to 15, in which, in a first step, the body of vegetation, of which the underlay has already been provided with holes, is rolled out flat on a film secure against root penetration, in a second step the body of vegetation is filled with substrate and germinative plant material and cared for horticulturally, and in a third step the body of vegetation is rolled up and conveyed to the roof.

1/1

